Canadian Water Quality Guidelines

Katherine Thibault
Environment Canada

CANADIAN WATER QUALITY GUIDELINES

FOR PRESENTATION TO THE
CANADIAN WATER RESOURCES ASSOCIATION
LETHBRIDGE, ALBERTA
JUNE 1985

Katherine Thibault
Water Quality Objectives Division
Water Quality Branch
Inland Waters Directorate
Environment Canada

May 1985

1. Introduction

The Water Quality Branch of Environment Canada is involved in the development of the Canadian Water Quality Guidelines. The project was taken on at the request of the Canadian Council of Resource and Environment Ministers (CCREM). Their sanctioning of this project represents the willingness and cooperation of the provinces, territories, and the federal government to work together towards a better understanding of water quality and the means to strike a balance between industrial growth and environmental quality, both of which are essential to our nation's present and future well-being.

2. Definitions

For the purposes of this discussion, I will review the CCREM definitions of certain terms as they apply to our work.

1. Criteria: scientific data evaluated to derive the recommended limits for water uses.

2. Water quality guidelines: numerical concentration or narrative statement recommended to support and maintain a designated water use.

3. Water quality objective: a numerical concentration or narrative statement, which has been established to support and protect the designated uses of water at a specified site.

4. Water quality standard: a water quality objective that is recognized in enforceable environmental control laws of a level of government.

Criteria, for the most part, relate to dose-response relationship information on specific parameters or variables (e.g. heavy metals, pesticides and nutrients) obtained from scientific investigations. Examples of criteria include plant growth and yield studies, the LD_{50} and LC_{50} toxicity tests on mammals and fish as well as chronic exposure testing, physiological and pharmacokinetic studies.

In developing guidelines for water quality, the data obtained from criteria documents are related to uses. Five uses are considered in the Canadian Water Quality Guidelines. They are:

- raw water for drinking water supply
- recreational water quality and aesthetics
- freshwater aquatic life
- agricultural uses (includes irrigation and livestock watering)
- industrial water supplies.

The guidelines will present recommendations on levels of chemical, physical and biological parameters necessary to protect these uses of water. They will provide a uniform basis from which authorities responsible for water quality will be able to assess the quality of the water and implement remedial or preventative measures to maintain and protect designated uses.

The use of water quality objectives as a preventative and remedial management option is showing promise, particularly as the Canadian public expresses increasing concern over water resources and demands that the authorities responsible for water quality be held accountable for the state of these resources.

The development and implementation of water quality objectives involves negotiations among all parties with a vested interest in a body of water, or portion thereof. The development of site-specific water quality objectives requires water quality guidelines, data on baseline or ambient water quality (historical and present, where available) and information on socio-economic factors to address the issues in question at the site.

In Canada, the application and use of water quality objectives depends on the cooperation of all interested parties. They are in no way legally binding. Objectives have been used by the International Joint Commission through the Canada-United States Great Lakes Water Quality Agreement as a means of respecting the 1909 Boundary Waters Treaty, which specifies that "...boundary and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other." They have also been used for other bilateral agreements such as in the international zone of the Saint John River (New Brunswick) for restoration and on the Poplar River (Saskatchewan) to permit development in Canada while protecting the interests of U.S. farmers downstream. The Prairie Provinces Water Board has also used objectives in their efforts to develop an approach for equitably sharing the boundary and transboundary water resources under their jurisdiction.

In the United States, the concept of water quality objectives, or criteria as they are known there, has been incorporated into the legislative process. Water quality standards in the U.S. are legally enforceable.

3. Historical Summary

The Water Quality Branch's initial involvement with water quality guidelines dates back to 1972, with the publication of the Guidelines for Water Quality Objectives and Standards. A second publication, Guidelines for Surface Water Quality was published in response to the Federal Policy

Statement on Inland Waters of 1977, in which the federal government committed itself to the restoration and protection of water quality by developing water quality objectives according to water uses.

These guidelines were prepared by the Water Quality Branch and designed to present information on water quality in 3 volumes: Volume 1 dealt with inorganic chemical substances, Volume 2 with organic substances and Volume 3 was to include physical, microbiological and radiological parameters.

The characteristics of each parameter and their relation to water quality were described in individual booklets and this information was based on literature reviews of original research. The first booklets, published in 1979, included arsenic, cadmium, chromium, mercury, nickel and selenium. The list of parameters has now reached 14.

Not only has the federal government been involved in the development of water quality guidelines but a number of provinces have initiated similar efforts. Guidelines are available from the provinces of Ontario, Manitoba, Alberta and Saskatchewan. Guidelines are also in preparation by the provinces of Quebec and British Columbia. Other agencies use guidelines developed by others and adapt them to the conditions found within their regions.

In 1983, at the annual meeting of the Canadian Council of Resource and Environment Ministers, the question of discrepancies in the guidelines available across the country was raised. A Task Force was established to explore this problem and was asked to (1) inventory water quality criteria and (2) review and make recommendations to Council on the desirability of, and possibilities for, a harmonization of guidelines throughout Canada.

As a result of its investigations, the Task Force on Water Quality Guidelines made 6 recommendations. Two of the recommendations were that:

1. an inventory of water quality guidelines and objectives be published and,

2. Canadian guidelines for water quality be developed and published.

The Task Force felt that there was a need for harmonized guidelines for water quality across the country, particularly now to meet growing public concern regarding the quality of these resources and to assist in developing water quality management strategies to address both the present quality and future of these resources. The Task Force requested that a report be issued on research priorities to address deficiencies that may be identified during the preparation of these guidelines. This recommendation is seen as an opportunity to suggest research in particular areas of water quality and thereby increase the reliability and utility of the proposed national guidelines in terms of future updates.

The Task Force report was tabled at the 1984 annual meeting of the Canadian Council of Resource and Environment Ministers and 5 of the recommendations met with unanimous approval. As a result, the CCREM has published a report on Canadian water quality issues and an inventory of water quality guidelines and objectives. The Task Force was also asked to proceed with the development of the Canadian Water Quality Guidelines and Environment Canada was called on to take the lead in this initiative.

4. Development of the Canadian Water Quality Guidelines

The workplan for the development of the Canadian Water Quality Guidelines, as set out by Environment Canada, calls for input from the provinces, territories and a number of federal departments, such as Agriculture, Health and Welfare, Fisheries and Oceans, and Regional Industrial Expansion. Members of these federal departments have joined Environment Canada in providing input and will review the guidelines for each use. These drafts will be forwarded to the provincial members of the Task Force for technical review and comment. The final report will be presented at the 1986 CCREM annual meeting.

For this publication, the recommendations and supporting rationale for each parameter will largely be based on existing data from national and international sources. For each use, only those parameters of concern to a particular use will be dealt with. The existing material will be reviewed to determine its appropriateness for Canadian conditions. Throughout this process, many information gaps will likely be identified. These deficiencies will be discussed in a separate report on research needs.

Environment Canada's Water Quality Objectives Division in the Western and Northern Region, with the cooperation of Agriculture Canada, will be preparing the chapter on water quality guidelines for Canadian agricultural uses. The major uses examined will be irrigation and livestock watering.

The guidelines for agricultural uses will be based on the widely used and accepted source of information, the Water Quality Criteria 1972, prepared by the U.S.-E.P.A., also known as the "Blue Book". The list of parameters presented in the agricultural section of this volume will be expanded, according to concerns identified within Agriculture Canada and by the provinces. Where data are available, these guidelines will be amended to suit Canadian conditions. As of May, the general list of parameters for consideration will include:

A. Water For Livestock (including beef and dairy cattle, sheep, swine, horses and poultry)
   - effects of salinity
   - toxic substances (ions, elements, algae, radionuclides)
   - pesticides
   - pathogens (microbial pathogens, parasitic organisms)

In addition to this list, 6 parameters not previously documented in the "Blue Book" will be examined:
   - dissolved oxygen
   - pH
   - filterable residues

- total dissolved residues
- nickel
- uranium.

B. Water for Irrigation

- effects of salinity
- sodium absorption
- nutrients
- soil types
- radionuclides
- phytotoxic trace elements
- pesticides
- pathogens
- use of wastewater.

The section on irrigation uses will consider three major types of irrigation practices: surface, sprinkler and trickle. Canadian data on crop tolerance to salinity will be tabulated and information on the physical and chemical properties of Canadian soils in relation to salinity and the presence of elements in irrigation water will also be discussed.

In general, the response from Agriculture Canada indicate that the "Blue Book" needs to be updated. Specialists have reported that many Canadian references are available to provide a rationale for Canadian conditions.

Regrettably, owing to time constraints in preparing these guidelines, specialists will be unable to recommend safe levels for livestock watering for the 600 pesticides registered for use in Canada. To overcome this problem, a general recommendation has been suggested advising non-use of water suspected of being contaminated by pesticides, pending professional advice.

Agricultural experts have reviewed the documents currently used to determine irrigation water quality and indicate that the sourcebook of data for this use used in the United States is the U.S. Department of Agriculture Handbook 60. It was published in 1954 and was the basis for agricultural data in the 1972 U.S.-E.P.A. "Blue Book". For the purposes of the Canadian Water Quality Guidelines, these data will be supplemented by the publication entitled Irrigation Water Quality Guidelines, developed by Ayres and Westcott and published by the United Nations Food and Agricultural Organization. These guidelines will provide information related to specific problems such as, crop yields and salinity, soil characteristics and specific ion toxicities.

The problem of adapting the "Blue Book" criteria, developed in the arid and semi-arid areas of the United States, to Canadian conditions is one which the Western provinces have been grappling with for many years and one which will be addressed in the Guidelines. At the moment, a number of approaches are being explored, including recommendations that criteria be adjusted based on a factor derived from the effective rainfall and crop water requirements.

5. Summary

The development of the Canadian Water Quality Guidelines should be viewed as the third step in a 5-part process. The first step involved independent efforts at developing guidelines on a federal and provincial scale. At the request of the Canadian Council of Resource and Environment Ministers, the second step, that is the inventory of guidelines and objectives used across Canada, was initiated.

The third step is the development of the Canadian Water Quality Guidelines. These guidelines are designed to condense data available from disciplines relevant to water quality and to provide general concentrations for parameters required to support and protect five uses of water in Canada. Their purpose is to establish a uniform basis from

which the authorities responsible for water quality across Canada can evaluate the quality of our water resources, assess remedial or preventative measures and implement management options such as the development of site-specific water quality objectives.

The Canadian Water Quality Guidelines will provide parameter concentrations and supporting documentation for 5 uses of water:

1. raw water for drinking water supply
2. recreational water quality and aesthetics
3. freshwater aquatic life
4. agricultural uses
5. industrial water supply

The agricultural uses will cover both livestock watering and irrigation uses. The list of parameters in this section will be based on those from the 1972 U.S.-E.P.A. "Blue Book" and expanded, according to the concerns identified by Agriculture Canada and the provinces. Whenever possible, these data will be adapted to suit Canadian conditions.

Response from Agriculture Canada to date indicates a definite need to update the "Blue Book" criteria for agricultural uses. Numerous references with Canadian data have been submitted and suggested. In addition, specialists from many areas of the Department of Agriculture will be available to comment and review the Guidelines prepared by the Branch.

The development of the Canadian Water Quality Guidelines is bringing together numerous federal departments and their provincial counterparts. It is hoped that this exercise and the resulting discussions relating to the Guidelines will focus attention on research priorities to address water quality requirements in Canada from a technical point of view and assist water quality managers in assessing water quality and opting for the best methods to protect our water resources.

In referring back to the five steps in the development of Canadian water quality guidelines, the fourth step is the report on data gaps and research priorities, recommended by the CCREM Task Force on Water Quality Guidelines. The conclusions drawn from this document will help to determine both future development of water quality guidelines and the direction of research in matters of water quality.

Finally, the fifth step will involve reviewing the guidelines on a periodic basis to update the information contained therein and to maintain and expand the cross-Canada contacts and information exchange that has begun with this exercise of developing the Canadian Water Quality Guidelines. We remain open to suggestions and advice from professionals such as yourselves and invite you to submit comments and recommendations to our office.

WATER QUALITY CRITERIA

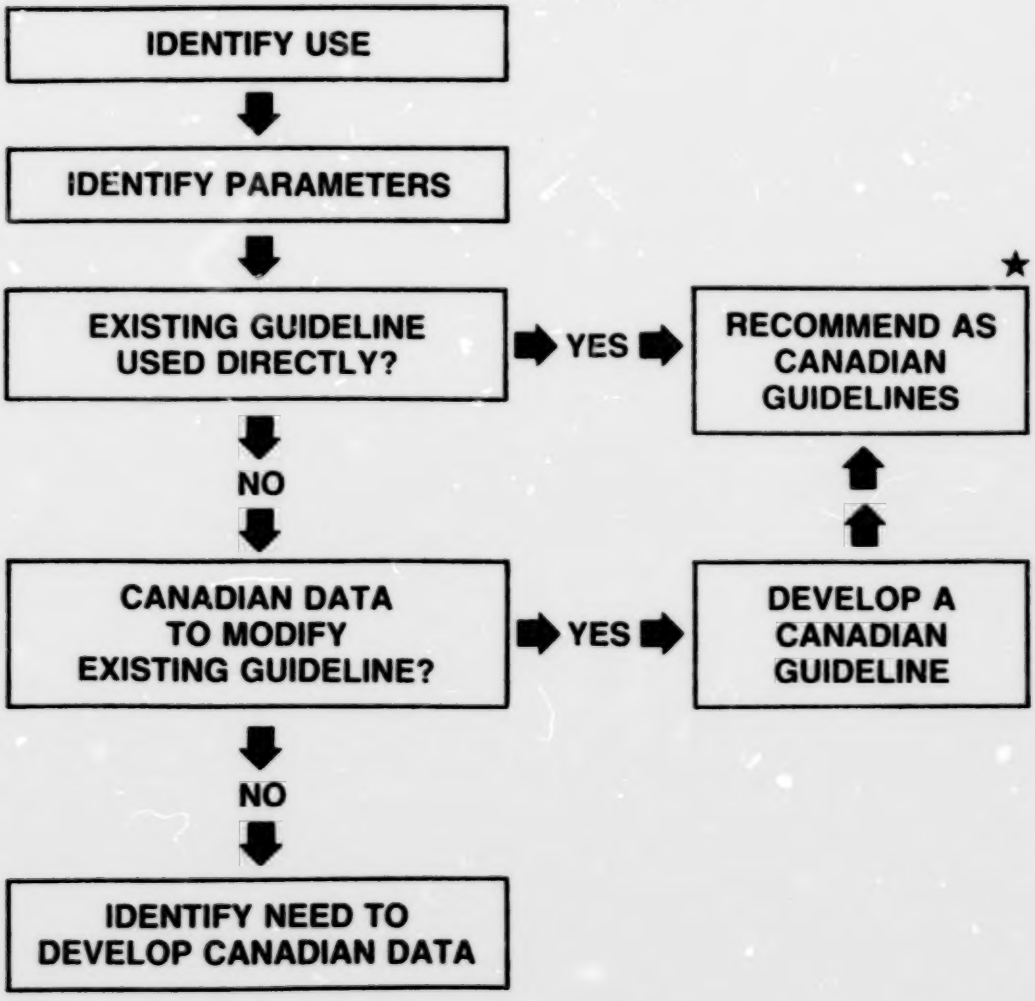
WATER QUALITY GUIDELINES

LOCAL CONDITIONS, SOCIAL AND ECONOMIC FACTORS

WATER QUALITY OBJECTIVES

SITE-SPECIFIC

PROCEDURE FOR DEVELOPING CANADIAN GUIDELINES FOR WATER QUALITY



★ Endorsement by CCREM

CANADIAN WATER QUALITY GUIDELINES

In October 1984, the Canadian Council of Resource and Environment Ministers approved a recommendation calling for the development of the Canadian Water Quality Guidelines. The purpose of the Guidelines is to provide the basic scientific information, required by provincial and federal agencies, to evaluate water quality problems and to establish water quality objectives for lakes and rivers under their respective jurisdictions. Agriculture is one of the five major uses covered in the Canadian Water Quality Guidelines and includes both irrigation and livestock watering requirements.

The Canadian Water Quality Guidelines will be published in 1987 by the Water Quality Branch of Environment Canada, the federal agency responsible for developing them. This paper will discuss the development of the guidelines for irrigation from the point of view of application of water at the sprinkler nozzle. It will focus on chemicals of concern to irrigation and concentrations recommended to protect and support this use. A progress report dealing with knowledge gaps, problems and implications for water resource policies will also be discussed.

RECOMMANDATIONS POUR LA QUALITE DES EAUX AU CANADA

Au mois d'octobre dernier, le Conseil canadien des ministres des ressources et de l'environnement a approuvé une recommandation concernant le développement des "Recommandations pour la qualité des eaux au Canada". Le but des Recommandations est de fournir aux organismes provinciaux et fédéraux l'information scientifique de base nécessaire à l'évaluation de problèmes relativement à la qualité des eaux et à l'élaboration des objectifs de qualité pour les lacs et les cours d'eau qui relèvent de leur compétence. Les utilisations à des fins agricoles comptent parmi les cinq usages principaux décrits dans les "Recommandations pour la qualité des eaux au Canada" et comprennent l'irrigation et l'alimentation du bétail.

La Direction de la qualité des eaux, qui relève du ministère de l'Environnement, s'est vue confier la tâche de préparer les "Recommandations pour la qualité des eaux au Canada", que l'on prévoit présenter en 1987. Le thème de cette présentation sera axé sur le développement des recommandations pour l'eau pour fin d'irrigation. On traitera du progrès de la préparation des recommandations, des produits chimiques d'intérêt à l'irrigation, des concentrations recommandées afin de protéger et de permettre cet usage, des lacunes d'information, des problèmes et des conséquences que pourront amener ces recommandations sur les politiques des ressources en eau.